

increased earnings and would be committed to make similar additional cost savings in every future year. Returning earnings from cost reductions would be exactly what occurs under traditional cost-plus regulation with regulatory lag and would constitute a failure to reward efficiency improvements that the Commission sought to encourage with price caps. Moreover, it would be wholly incorrect to incorporate a one-time cost reduction into a long-term productivity offset by effectively assuming that the cost reduction would continue to take place in every year.

B. Comparison of X factors from TFP and Historical Revenue Methods

Paragraph 83 deals with the mathematical relationship between a TFP-based X factor and one based on the Historical Revenue Method. Because of the distortions introduced from using accounting data (including accounting measures of depreciation, sunk costs, authorized cost of capital, calculation of interstate earnings, etc.), there is no precise mathematical relationship. The use of accounting data in place of the correct economic data (which is used in a proper TFP study) introduces an "apples to oranges" feature into any attempt to compare the methods rigorously.

If, hypothetically, the Historical Revenue Method were used with *economic* cost measures, there could be a direct comparison. By definition, TFP accounts for all costs, including the cost of capital. Therefore, on average over sufficiently long time periods, revenues would just equal costs and there would be no economic profit (i.e., the firm would earn its cost of capital). Therefore, given a correct measure of the *economic* (not accounting) cost of capital, an earnings-based method could conceivably produce a backward-looking measure of productivity achievement equivalent to that produced by the TFP-based method. However, to date, no party has proposed using such a version of the Historical Revenue Method.

There are several qualifications to this statement of equivalence. First, the Historical Revenue Method measures a *deviation* from an established productivity target and

actual results. So unlike an ordinary TFP-based calculation of X , this method cannot stand on its own, and it is only useful when a TFP-based measure of the productivity target is already available. Second, when added to the target, the results of the Historical Revenue Method measure the difference between the output price growth of the industry and US output price growth ($GDP-PI$); they do not measure TFP growth directly. The relationship between the output price growth differential and telecommunications industry TFP is the following:

$$TFP_i = X^{HRM} - GDP-PI + w_i.$$

That is, industry productivity growth (TFP_i) consists of the sum of

- (i) the difference between the result of the Historical Revenue Method (X^{HRM}) and economy-wide output price inflation ($GDP-PI$) and
- (ii) the level of the input price inflation rate (w_i) of the telecommunications industry.

Third, in order for this equivalence to hold, all of the problems of using accounting data to represent economic concepts for a subset of the firm's services would have to be overcome, including measuring economic depreciation, valuation of sunk costs, measuring the cost of capital, and the inability to measure profits meaningfully for interstate services in the presence of common costs. Finally, the above hypothetical implementation of the Historical Revenue Method is applied to the firm as a whole. AT&T's application of this method to a subset of LEC services (interstate carrier access) is invalid for the same reasons that productivity studies for a subset of the firm's services are generally invalid. Because these requirements for equivalence are not satisfied for telecommunications firms, the Historical Revenue Method will yield biased estimates of TFP growth for such firms and should not be used to set a productivity target in a price cap plan.

V. THE HISTORICAL PRICE METHOD IS THE DUAL OF THE TFP METHOD

While the economic theory of duality shows that productivity can be calculated from either the differential rates of growth of input and output quantities or prices, there are practical differences in the calculations which favor using quantity indices to measure changes in TFP. The *FFN* explores this relationship (at ¶s 84-86) between the historical price method and the TFP method for determining a productivity offset in the annual price adjustment formula for a price-cap-regulated firm. In economic theory, TFP growth and the change in unit costs can be measured using the same set of basic assumptions and the relationship between input and output quantities or input and output prices. In his classic exposition of the theory of total factor productivity measurement, D.W. Jorgenson begins with the identity that the value of output is equal to the value of input (equation (1)). He then differentiates this identity with respect to time to derive the change in TFP as the difference between Divisia quantity indexes of outputs and inputs. In a footnote, he observes that

Any index of total factor productivity may be computed either from quantity indexes of total output and total input or from the corresponding price indexes. The whole analysis that follows could be carried out in an entirely equivalent way, using price indexes instead of quantity indexes.⁴⁰

In particular, measurement of the change in TFP by either the price or quantity method requires the assumption that the value of input equal the value of output in each period—or at least that the data be adjusted so that this identity holds approximately in the historical period.⁴¹

These basic facts from the economic theory of duality have several practical consequences. First, the apparent ability of the historical price method to produce a productivity offset or a measure of productivity growth *for an individual service*—or for

⁴⁰ D.W. Jorgenson, "The Embodiment Hypothesis," *The Journal of Political Economy*, Vol. LXXIV, February 1966 at 2-3.

⁴¹ This dependence on the constant equality of revenue and cost over time makes intuitive sense. If a firm were to increase economic earnings rather than lower prices to reflect productivity growth, the price method applied to that data would underestimate true productivity growth. Recall that the Frantrup-Uretsky study adjusted prices to hold earnings constant. The Christensen study accomplishes this by using an independent measure of the cost of capital.

interstate carrier access services as a group—is illusory. When output price data are adjusted to keep earnings constant across the historical period, accounting costs must be assigned to individual services.⁴² That assignment is no different—in principle—from the measurement of interstate access TFP growth from Part 36 and Part 69 cost and revenue data, which is acknowledged to be inappropriate. Second, while duality implies that TFP growth measured by quantities and prices will be the same, it does not suggest that failure of any of the assumptions of the method will have the same effect on the two TFP growth measures.

For example, suppose economic earnings vary from year to year during the historical period. TFP growth measured by quantities could differ markedly from TFP growth measured by prices. If prices are adjusted in each period to keep measured economic earnings constant, errors in the adjustment would affect TFP as measured by prices more than TFP as measured by quantities. Using the historical price method, TFP growth is calculated from *changes* in prices (i.e., the difference between the rates of growth of input and output prices). Using the quantity method, prices enter the TFP growth calculation only

- (i) as part of the revenue and expenditure weights used to calculate aggregate quantity indices of outputs and inputs; and
- (ii) as *levels* rather than annual changes.

Thus errors in measuring input or output prices (or adjusting output prices to keep accounting earnings constant) have a larger effect on TFP growth as measured by price rather than quantity. Possibly for these reasons, it is instructive to note that, without exception, empirical studies of productivity growth use quantity indices rather than price indices.⁴³

Third, the practical decision whether to base historical measurements on quantities or prices must take into account the use to which the measurement will be put. In the present

⁴² Thus when NERA and Frentrup-Uratsky calculated X using the historical price method in CC Docket No. 87-313, they adjusted prices to hold earnings constant, and that adjustment required the calculation of the total cost of interstate switched access services. The calculation therefore erroneously assigns a portion of the fixed costs of the LECs to interstate switched access services and presented arbitrary and incorrect estimates of TFP.

⁴³ See, for example, D. Jorgenson, F. Gollop and B. Fraumeni, *Productivity and U.S. Economic Growth*, Cambridge: Harvard University Press, 1987, at 4 and 152-159.

exercise, the results will be used essentially to forecast future values of productivity growth to determine a reasonable target productivity growth for the price-cap regulated LECs. Since productivity growth—relative to U.S. average productivity growth—is the ultimate source of real price reductions in any market, it is preferable to study productivity growth directly, rather than indirectly through the price changes that follow from productivity growth. In particular, possible differences between the historical period and the future will be easier to quantify directly in terms of productivity growth than indirectly in terms of output price growth.⁴⁴

Finally, the duality of price and output-based measures of productivity growth can be used as to check results. As discussed above, we cannot use duality to reconcile the historical price calculations for interstate switched access services with the quantity-based productivity measures calculated by Christensen: the latter applies to all the firm's services and would be comparable only to a price-based productivity study performed on all of the firm's services.

It is straightforward to compare a price-based measure of the achieved X for the telecommunications industry with the historical X calculated by Christensen. Indeed, the Commission Staff has already performed such a comparison: the Spavins-Lande studies filed in CC Docket No. 87-313 are long run measures of the X achieved by the telecommunications industry.⁴⁵ As updated through 1993 in the NERA Reply Comments, the long run (1929-1993) productivity offset calculated from telecommunications industry price data averaged about 2.1 percent, unchanged from the Spavins-Lande finding for the 1929-1987 period. Applying the method to the post-divestiture period, we find that the Spavins-Lande historical price-based value of X for the period examined in the Christensen direct studies (1984-1993) is 2.4 percent which corresponds reasonably closely with the value of X proposed by Dr. Christensen which uses the long run input price differential of 0. This

⁴⁴ This difference is particularly relevant when prices were regulated differently between the historical period and the future. Much of the work in the original studies in CC Docket 87-313 using the historical price method was done to correct measured prices for changes over time in regulatory rules and procedures.

⁴⁵ *Supplemental Notice of Proposed Rulemaking*, CC Docket 87-313, March 12, 1990, Appendix D and *Second Report and Order*, CC Docket 87-313, October 4, 1990, Appendix D.

correspondence provides some confirmation that—at the level of aggregation of the entire firm—the historical price method and the direct TFP method yield similar results, as they should under the principles of duality.⁴⁶

In summary, although economic theory suggests that prices and quantities can be used symmetrically to calculate productivity growth, there are serious practical concerns with historical price-based methods in these circumstances. Price-based methods can replicate accurately the outcome of historical regulation on prices and can determine an X that will assure customers that real price growth will be slower under price regulation than it had been under the historical regulatory regime. However, to give economic support to the historical price method requires (i) that prices be adjusted to undo the multitude of regulatory changes over time and (ii) that the analysis be undertaken at the level of the total firm rather than interstate services or individual services.⁴⁷ When that analysis is undertaken, we see that the historical price method yields approximately the same historical value of the X-Factor as obtained from the direct measurement of TFP growth based on input and output quantities.

⁴⁶ Note that if the short run point estimate of the input price differential were added to Dr. Christensen's TFP differential, the correspondence between the direct and dual estimates of industry productivity would disappear. This fact implies that only the long-run adjustment for differences in input price growth rates—essentially zero—is consistent with both the empirical evidence and the implications of duality.

⁴⁷ Note that measures of the historical productivity offset based on carrier access prices proposed in this Docket do not give such support because they are undertaken for only a subset of the LEC's services.

VI. THE CONSUMER PRODUCTIVITY DIVIDEND

Paragraphs 94-95 of the *FFN* note that a consumer productivity dividend (CPD) was originally added to the historical X factor (calculated prior to price regulation) to ensure that customers benefited from the anticipated increase in the rate of growth of TFP stemming from the adoption of price cap regulation. The *FFN* then asks if a CPD should again be added to an historical X factor measured over a period in which price cap regulation were in force. There are at least two reasons why—irrespective of the announced level of the productivity offset—a continued or additional CPD is not warranted. First, adding a CPD to an historical X factor measured over a period that includes price cap regulation would effectively double-count expected productivity gains from regulatory reform. Second, interstate price caps are currently approximately 2.5 percent lower than would otherwise have been because of the 0.5 percent CPD put in place at the beginning of price cap regulation for LECs. It is unclear why a shift to an improved form of regulation in the past would continue to yield additional efficiencies in the future. One might think that a one-time reduction in prices should be required to match a one-time reduction in costs from improved regulation. However, because it is built in as part of the productivity offset, the interstate CPD automatically increases over time. Indeed, since 1991, some five years of a CPD are embedded in the LECs' current rates.

VII. CONCLUSION

Three important areas of Commission concern are addressed in this study. First, evidence regarding the magnitude and uncertainty of the measured input price differential in a price cap plan suggests that point estimates calculated over a relatively short period of time are too unreliable to support their use in a mechanical formula. If a productivity target were increased to account for the post-divestiture difference in LEC and U.S. input price growth, the LECs would be doubly penalized when interest rates begin to rise and LEC input prices begin to rise more rapidly than those of the U.S. as a whole.

Second, use of historical TFP measures to determine the productivity offset in the price adjustment formula is reasonable. Productivity growth must be calculated at the level of

the entire firm. Efforts to calculate service-specific productivity growth are misguided because the production function for telecommunications services is not separable for interstate and intrastate services, for regulated and nonregulated services, or for finer disaggregates of services. It is not possible to estimate service-specific TFP growth. Similarly, adjustments to total firm measures of productivity growth to account for differential output growth or contribution by service are also improper because there is no underlying difference in productivity growth rates across services for these adjustments to approximate.

Third, while calculating productivity growth from price or earnings data is possible in theory, it is more academic than practical. The Historical Revenue method requires that accounting measures of earnings and depreciation correspond to economic concepts and that price cap regulation have been applied correctly and consistently over the historical period. Similarly, the Historical Price Method requires that the price data be adjusted to keep measured economic earnings constant, and errors in those adjustments are likely to have a larger effect on measured TFP growth than when direct, quantity-based measures of productivity growth are calculated. But the main drawback to both approaches is that—despite appearances—they cannot produce meaningful productivity growth measures for LEC interstate services. Productivity growth for LEC interstate services calculated by these methods entails tacit assignments of fixed common costs to particular services, so that the resulting measure of productivity growth is as arbitrary as the undefined concept—the productivity growth of a subset of services connected through fixed common costs—it attempts to quantify. Such measures have no theoretical support in economics and can play no useful role in the measurement of productivity growth to set the parameters of a price cap plan.

REGRESSION: TELEPHONE INPUT PRICE GROWTH - CHRISTENSEN 1 DATA

| Year | LEC Input Price Change | U.S. Input Price Change | Divestiture Binary Dummy | Moody's Pub Util Bonds | 1990-2 Dummy | Permanent Shift Hypothesis (Bush-Urutzky) | | | | |
|------|------------------------|-------------------------|--------------------------|------------------------|--------------|-------------------------------------------|---------|-------------|--------|-----------|
| A | B | C | E | D | E | Constant | | | | |
| | | | | | | Std Err of Y Est | -0.0027 | | | |
| | | | | | | R Squared | 0.0347 | | | |
| | | | | | | No. of Observations | 0.4322 | | | |
| | | | | | | Degrees of Freedom | 44 | | | |
| 1949 | 3.2% | -1.0% | 0 | 2.66% | 0 | | 40 | | | |
| 1950 | 5.1% | 6.3% | 0 | 2.62% | 0 | | | | | |
| 1951 | 8.8% | 7.9% | 0 | 2.88% | 0 | | | | | |
| 1952 | 8.8% | 1.2% | 0 | 2.96% | 0 | X Coefficient(s) | US IPr | Divestiture | Moody | |
| 1953 | 2.4% | 3.7% | 0 | 3.20% | 0 | Std Err of Coef. | 0.3402 | -0.0579 | 0.6489 | |
| 1954 | 1.9% | 0.6% | 0 | 2.90% | 0 | | 0.2338 | 0.0152 | 0.2093 | |
| 1955 | 5.4% | 6.6% | 0 | 3.08% | 0 | t-Statistic | 1.4553 | -3.8142 | 3.1007 | |
| 1956 | 1.7% | 0.7% | 0 | 3.36% | 0 | | | | | |
| 1957 | -1.1% | 3.7% | 0 | 3.89% | 0 | F-statistic | 10.1512 | | | |
| 1958 | 3.3% | 0.5% | 0 | 3.79% | 0 | (3,40) | | | | |
| 1959 | 5.4% | 7.0% | 0 | 4.38% | 0 | | | | | |
| 1960 | 4.2% | -0.6% | 0 | 4.41% | 0 | | | | | |
| 1961 | 3.9% | 3.6% | 0 | 4.35% | 0 | Temporary Shift Hypothesis | | | | |
| 1962 | 2.2% | 4.4% | 0 | 4.33% | 0 | Constant | -0.0061 | | | |
| 1963 | 1.0% | 3.8% | 0 | 4.26% | 0 | Std Err of Y Est | 0.0309 | | | |
| 1964 | 6.0% | 4.5% | 0 | 4.40% | 0 | R Squared | 0.5600 | | | |
| 1965 | 0.5% | 5.7% | 0 | 4.49% | 0 | No. of Observations | 44 | | | |
| 1966 | 1.1% | 4.8% | 0 | 5.13% | 0 | Degrees of Freedom | 39 | | | |
| 1967 | 1.9% | 2.0% | 0 | 5.51% | 0 | | US IPr | Divestiture | Moody | 1990-1992 |
| 1968 | 4.2% | 4.4% | 0 | 6.18% | 0 | X Coefficient(s) | 0.3209 | -0.0851 | 0.7174 | 0.0740 |
| 1969 | 2.1% | 3.7% | 0 | 7.03% | 0 | Std Err of Coef. | 0.2085 | 0.0158 | 0.1877 | 0.0220 |
| 1970 | 3.8% | 3.3% | 0 | 8.04% | 0 | | | | | |
| 1971 | 4.2% | 6.8% | 0 | 7.39% | 0 | t-Statistic | 1.5392 | -5.3981 | 3.8225 | 3.3658 |
| 1972 | 8.0% | 7.2% | 0 | 7.21% | 0 | | | | | |
| 1973 | 0.6% | 6.3% | 0 | 7.44% | 0 | F-statistic | 12.4114 | | | |
| 1974 | 5.9% | 4.2% | 0 | 8.57% | 0 | (4,39) | | | | |
| 1975 | 14.2% | 9.4% | 0 | 8.83% | 0 | | | | | |
| 1976 | 10.7% | 9.1% | 0 | 8.43% | 0 | | | | | |
| 1977 | 6.1% | 8.8% | 0 | 8.02% | 0 | | | | | |
| 1978 | 7.8% | 7.8% | 0 | 8.73% | 0 | | | | | |
| 1979 | 7.2% | 8.2% | 0 | 9.63% | 0 | | | | | |
| 1980 | 14.6% | 6.6% | 0 | 11.94% | 0 | | | | | |
| 1981 | 11.6% | 9.9% | 0 | 14.17% | 0 | | | | | |
| 1982 | 12.1% | 3.7% | 0 | 13.79% | 0 | | | | | |
| 1983 | 12.8% | 5.6% | 0 | 12.04% | 0 | | | | | |
| 1984 | 1.8% | 7.4% | 1 | 12.71% | 0 | | | | | |
| 1985 | 0.1% | 4.0% | 1 | 11.37% | 0 | | | | | |
| 1986 | 1.3% | 3.8% | 1 | 9.02% | 0 | | | | | |
| 1987 | 1.7% | 3.1% | 1 | 9.38% | 0 | | | | | |
| 1988 | -3.2% | 4.4% | 1 | 9.71% | 0 | | | | | |
| 1989 | -3.7% | 4.1% | 1 | 9.26% | 0 | | | | | |
| 1990 | 11.8% | 4.2% | 1 | 9.32% | 1 | | | | | |
| 1991 | 1.3% | 2.9% | 1 | 8.77% | 1 | | | | | |
| 1992 | 4.4% | 5.1% | 1 | 8.14% | 1 | | | | | |

Source: CC: Docket 94-1, First Report and Order, Released April 7, 1995. Appendix F, Christensen Affidavit Data

REGRESSION: TELEPHONE INPUT PRICE GROWTH - CHRISTENSEN 2 DATA

| Year | LEC Input Price Change | U.S. Input Price Change | Divestiture Binary Dummy | Yield on Moody's Pub Util Bonds | 1990-2 Dummy | Permanent Shift Hypothesis (Bush-Uralsky) | | | | |
|------|------------------------|-------------------------|--------------------------|---------------------------------|--------------|-------------------------------------------|---------|-------------|--------|-----------|
| A | B | C | D | E | F | Constant | | | | |
| 1960 | 2.4% | 1.7% | 0 | 4.41% | 0 | Std Err of Y Est | | -0.0046 | | |
| 1961 | 4.0% | 2.9% | 0 | 4.35% | 0 | R Squared | | 0.0308 | | |
| 1962 | 3.1% | 4.5% | 0 | 4.33% | 0 | No. of Observations | | 0.4440 | | |
| 1963 | 4.9% | 3.9% | 0 | 4.26% | 0 | Degrees of Freedom | | 33 | | |
| 1964 | 2.4% | 5.4% | 0 | 4.40% | 0 | | US IPr | Divestiture | Moody | |
| 1965 | 2.4% | 4.4% | 0 | 4.49% | 0 | X Coefficient(s) | 0.3140 | -0.0480 | 0.5794 | |
| 1966 | 1.5% | 5.5% | 0 | 5.13% | 0 | Std Err of Coef. | 0.3179 | 0.0144 | 0.2350 | |
| 1967 | 5.0% | 2.8% | 0 | 5.51% | 0 | t-Statistic | 0.9876 | -3.3365 | 2.4653 | |
| 1968 | 6.1% | 6.4% | 0 | 6.18% | 0 | F-statistic | 7.7208 | | | |
| 1969 | 2.7% | 4.0% | 0 | 7.03% | 0 | (3,29) | | | | |
| 1970 | 4.0% | 3.2% | 0 | 8.04% | 0 | | | | | |
| 1971 | 6.5% | 6.8% | 0 | 7.39% | 0 | Temporary Shift Hypothesis | | | | |
| 1972 | 7.6% | 6.0% | 0 | 7.21% | 0 | Constant | | -0.0111 | | |
| 1973 | 6.6% | 8.6% | 0 | 7.44% | 0 | Std Err of Y Est | | 0.0247 | | |
| 1974 | 4.8% | 4.2% | 0 | 8.57% | 0 | R Squared | | 0.6653 | | |
| 1975 | 9.3% | 8.5% | 0 | 8.83% | 0 | No. of Observations | | 33 | | |
| 1976 | 9.2% | 9.2% | 0 | 8.43% | 0 | Degrees of Freedom | | 28 | | |
| 1977 | 4.8% | 7.3% | 0 | 8.02% | 0 | | US IPr | Divestiture | Moody | 1990-1992 |
| 1978 | 7.3% | 7.0% | 0 | 8.73% | 0 | X Coefficient(s) | 0.2774 | -0.0752 | 0.6816 | 0.0731 |
| 1979 | 2.9% | 7.7% | 0 | 9.63% | 0 | Std Err of Coef. | 0.2549 | 0.0133 | 0.1903 | 0.0177 |
| 1980 | 6.9% | 7.0% | 0 | 11.94% | 0 | t-Statistic | 1.0881 | -5.6677 | 3.6346 | 4.1423 |
| 1981 | 11.0% | 9.5% | 0 | 14.17% | 0 | F-statistic | 13.3067 | | | |
| 1982 | 9.3% | 3.1% | 0 | 13.79% | 0 | (4,28) | | | | |
| 1983 | 13.7% | 6.2% | 0 | 12.04% | 0 | | | | | |
| 1984 | 1.8% | 6.5% | 1 | 12.71% | 0 | | | | | |
| 1985 | 0.1% | 4.0% | 1 | 11.37% | 0 | | | | | |
| 1986 | 1.5% | 3.8% | 1 | 9.02% | 0 | | | | | |
| 1987 | 1.7% | 3.2% | 1 | 9.38% | 0 | | | | | |
| 1988 | -3.2% | 4.6% | 1 | 9.71% | 0 | | | | | |
| 1989 | -3.7% | 4.2% | 1 | 9.26% | 0 | | | | | |
| 1990 | 11.8% | 4.3% | 1 | 9.32% | 1 | | | | | |
| 1991 | 1.3% | 2.9% | 1 | 8.77% | 1 | | | | | |
| 1992 | 4.4% | 5.1% | 1 | 8.14% | 1 | | | | | |

REGRESSION: INPUT PRICE DIFFERENTIAL - CHRISTENSEN 1 DATA

| Year | LEC-US | Divest | Moody's | 1990-2 | Permanent Shift Hypothesis (Bush-Uretsky) | | | |
|------|--------------------------|--------|---------|--------|-------------------------------------------|--|--|--|
| | Input Price Growth | | | | Constant | | | |
| A | B | C | D | E | Std Err of Y Est | | | |
| 1949 | 4.2% | 0 | 2.66% | 0 | R Squared | | | |
| 1950 | -1.2% | 0 | 2.62% | 0 | No. of Observations | | | |
| 1951 | 0.9% | 0 | 2.66% | 0 | Degrees of Freedom | | | |
| 1952 | 7.4% | 0 | 2.98% | 0 | | | | |
| 1953 | -1.3% | 0 | 3.20% | 0 | | | | |
| 1954 | 1.3% | 0 | 2.90% | 0 | | | | |
| 1955 | -1.2% | 0 | 3.08% | 0 | | | | |
| 1956 | 1.0% | 0 | 3.36% | 0 | | | | |
| 1957 | -4.8% | 0 | 3.89% | 0 | | | | |
| 1958 | 2.8% | 0 | 3.79% | 0 | | | | |
| 1959 | -1.6% | 0 | 4.38% | 0 | | | | |
| 1960 | 4.8% | 0 | 4.41% | 0 | | | | |
| 1961 | 0.3% | 0 | 4.36% | 0 | | | | |
| 1962 | -2.2% | 0 | 4.33% | 0 | | | | |
| 1963 | -2.8% | 0 | 4.28% | 0 | | | | |
| 1964 | 1.5% | 0 | 4.40% | 0 | | | | |
| 1965 | -5.2% | 0 | 4.49% | 0 | | | | |
| 1966 | -3.5% | 0 | 5.13% | 0 | | | | |
| 1967 | -0.1% | 0 | 5.51% | 0 | | | | |
| 1968 | -0.2% | 0 | 6.18% | 0 | | | | |
| 1969 | -1.6% | 0 | 7.03% | 0 | | | | |
| 1970 | 0.5% | 0 | 8.04% | 0 | | | | |
| 1971 | -2.6% | 0 | 7.38% | 0 | | | | |
| 1972 | 0.8% | 0 | 7.21% | 0 | | | | |
| 1973 | -5.7% | 0 | 7.44% | 0 | | | | |
| 1974 | 1.7% | 0 | 8.57% | 0 | | | | |
| 1975 | 4.8% | 0 | 8.83% | 0 | | | | |
| 1976 | 1.6% | 0 | 8.43% | 0 | | | | |
| 1977 | -2.5% | 0 | 8.02% | 0 | | | | |
| 1978 | -0.2% | 0 | 8.73% | 0 | | | | |
| 1979 | -1.0% | 0 | 9.63% | 0 | | | | |
| 1980 | 8.0% | 0 | 11.94% | 0 | | | | |
| 1981 | 1.7% | 0 | 14.17% | 0 | | | | |
| 1982 | 8.4% | 0 | 13.79% | 0 | | | | |
| 1983 | 7.2% | 0 | 12.04% | 0 | | | | |
| 1984 | -5.6% | 1 | 12.71% | 0 | | | | |
| 1985 | -3.9% | 1 | 11.37% | 0 | | | | |
| 1986 | -2.5% | 1 | 9.02% | 0 | | | | |
| 1987 | -1.4% | 1 | 9.38% | 0 | | | | |
| 1988 | -7.6% | 1 | 9.71% | 0 | | | | |
| 1989 | -7.8% | 1 | 9.28% | 0 | | | | |
| 1990 | 7.7% | 1 | 9.32% | 1 | | | | |
| 1991 | -1.6% | 1 | 8.77% | 1 | | | | |
| 1992 | -0.7% | 1 | 8.14% | 1 | | | | |

| Permanent Shift Hypothesis (Bush-Uretsky) | | | |
|-------------------------------------------|---------|-------------|--------|
| Constant | -0.0157 | | |
| Std Err of Y Est | 0.0375 | | |
| R Squared | 0.1702 | | |
| No. of Observations | 44 | | |
| Degrees of Freedom | 41 | | |
| | | Divestiture | Moody |
| X Coefficient(s) | -0.0440 | | 0.3484 |
| Std Err of Coef. | 0.0155 | | 0.1944 |
| t-Statistic | -2.8330 | | 1.7818 |
| F-statistic | 4.2036 | | |
| (2,41) | | | |

| Temporary Shift Hypothesis | | | |
|----------------------------|---------|-------------|--------|
| Constant | -0.0194 | | |
| Std Err of Y Est | 0.0344 | | |
| R Squared | 0.3179 | | |
| No. of Observations | 44 | | |
| Degrees of Freedom | 40 | | |
| | | Divestiture | Moody |
| X Coefficient(s) | -0.0701 | | 0.4046 |
| Std Err of Coef. | 0.0168 | | 0.1798 |
| t-Statistic | -4.1737 | | 2.2527 |
| F-statistic | 6.2128 | | 2.9429 |
| (3,40) | | | |

| 1990-1992 | | | |
|-----------|--|--|--|
| | | | |
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REGRESSION: INPUT PRICE DIFFERENTIAL - CHRISTENSEN 2 DATA

| Year A | LEC-US Input Price Growth B | Divestiture Binary Dummy B | Yield on Moody's Pub Util Bonds D | 1990-2 Dummy E | Permanent Shift Hypothesis (Bush-Uretsky) | | | |
|-----------|-----------------------------------------|-------------------------------------|-----------------------------------------------|----------------------|-------------------------------------------|-------------|--------|-----------|
| | | | | | Constant | | | |
| | | | | | Std Err of Y Est | | | |
| | | | | | R Squared | | | |
| | | | | | No. of Observations | | | |
| | | | | | Degrees of Freedom | | | |
| 1960 | 0.7% | 0 | 4.41% | 0 | | | | |
| 1961 | 1.1% | 0 | 4.35% | 0 | | | | |
| 1962 | -1.4% | 0 | 4.33% | 0 | X Coefficient(s) | Divestiture | Moody | |
| 1963 | 1.0% | 0 | 4.26% | 0 | Std Err of Coef. | -0.0338 | 0.3418 | |
| 1964 | -3.0% | 0 | 4.40% | 0 | | 0.0135 | 0.2200 | |
| 1965 | -2.0% | 0 | 4.49% | 0 | t-Statistic | -2.4835 | 1.5543 | |
| 1966 | -4.0% | 0 | 5.13% | 0 | | | | |
| 1967 | 2.2% | 0 | 5.51% | 0 | F-statistic | 3.4001 | | |
| 1968 | -0.3% | 0 | 6.18% | 0 | (2,30) | | | |
| 1969 | -1.3% | 0 | 7.03% | 0 | | | | |
| 1970 | 0.8% | 0 | 8.04% | 0 | | | | |
| 1971 | -0.1% | 0 | 7.39% | 0 | Temporary Shift Hypothesis | | | |
| 1972 | 1.8% | 0 | 7.21% | 0 | Constant | | | |
| 1973 | -2.0% | 0 | 7.44% | 0 | Std Err of Y Est | -0.0325 | | |
| 1974 | 0.6% | 0 | 8.57% | 0 | R Squared | 0.0275 | | |
| 1975 | 0.8% | 0 | 8.83% | 0 | No. of Observations | 0.4395 | | |
| 1976 | 0.0% | 0 | 8.43% | 0 | Degrees of Freedom | 33 | | |
| 1977 | -2.5% | 0 | 8.02% | 0 | | | | |
| 1978 | 0.3% | 0 | 8.73% | 0 | X Coefficient(s) | Divestiture | Moody | 1990-1992 |
| 1979 | -4.8% | 0 | 9.63% | 0 | Std Err of Coef. | -0.0595 | 0.4390 | 0.0714 |
| 1980 | -0.1% | 0 | 11.94% | 0 | | -0.0135 | 0.1874 | 0.0197 |
| 1981 | 1.5% | 0 | 14.17% | 0 | t-Statistic | -4.4281 | 2.3422 | 3.6289 |
| 1982 | 6.2% | 0 | 13.79% | 0 | | | | |
| 1983 | 7.5% | 0 | 12.04% | 0 | F-statistic | 7.5787 | | |
| 1984 | -4.7% | 1 | 12.71% | 0 | (3,29) | | | |
| 1985 | -3.9% | 1 | 11.37% | 0 | | | | |
| 1986 | -2.5% | 1 | 9.02% | 0 | | | | |
| 1987 | -1.5% | 1 | 9.38% | 0 | | | | |
| 1988 | -7.8% | 1 | 9.71% | 0 | | | | |
| 1989 | -7.9% | 1 | 9.26% | 0 | | | | |
| 1990 | 7.6% | 1 | 9.32% | 1 | | | | |
| 1991 | -1.6% | 1 | 8.77% | 1 | | | | |
| 1992 | -0.7% | 1 | 8.14% | 1 | | | | |

Source: CC: Docket 94-1, First Report and Order, Released April 7, 1995. Appendix F, NERA Data

EXHIBIT 1a

COMPETITIVE ACCESS PROVIDERS - Summary by State and City as of 11'95

| State | City | Competitor - Existing | Competitor - Planned |
|----------------|----------------|--------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| 1) Arizona | Phoenix | Teleport Comm Group (TCG) IntelCom Group (ICG) GST Telecom Electric Lightwave (ELI) MFS Communications (MFS) | |
| | Tucson | | Amer. Comm. Srvs. (ACSI) Brooks Fiber Comm. GST Telecom |
| 2) Colorado | Color. Springs | ICG | |
| | Denver | ICG TCG MFS | MCImetro |
| | Boulder | ICG | MFS TCG |
| 3) Idaho | Boise | | Phoenix FiberLink of Idaho |
| 4) Iowa | Des Moines | McLeod | |
| | Cedar Rapids | McLeod | |
| 5) Minnesota | Minneapolis | MFS Paragon Cable/ Fibrcom | |
| 6) Montana | | | |
| 7) Nebraska | Omaha | TCG | |
| 8) New Mexico | Albuquerque | | ACSI Brooks GST Telecom of NM Phoenix FiberLink of NM |
| | Las Cruces | | GST Telecom of NM |
| | Farmington | | GST Telecom of NM |
| | Santa Fe | | GST Telecom of NM |
| 9) No. Dakota | | | |
| 10) Oregon | Portland | ELI Paragon Cable Pacnet | MCImetro MFS Digital Direct |
| 11) So. Dakota | | | |
| 12) Utah | Salt Lake City | ELI | Phoenix FiberLink of Utah Qwest Communications |
| 13) Washington | Seattle | TCG MFS ELI | MCImetro |
| | Spokane | | FiberLink/Tel-West |
| 14) Wyoming | | | |

- This information represents publicly available information collected by U S WEST

EXHIBIT 1b

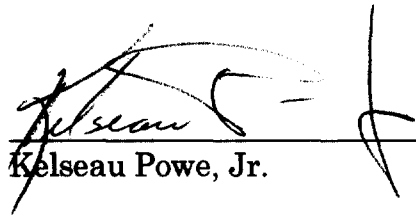
STATUS OF LOCAL EXCHANGE SERVICE COMPETITION

(AS OF NOVEMBER 1995)

| STATE: | DECISION TO PERMIT COMPETITION: | HAVE ANY COMPANIES APPLIED TO COMPETE? | ACTIVE COMPETITION | NOTES: |
|---------------|----------------------------------------|-----------------------------------------------|---------------------------|----------------------------------------------------------------------------------------------------------------------|
| Arizona | July 1995 | Yes | Not yet | Rules not yet in place. Industry workshops concluded. |
| Colorado | May 1995 | | Not yet | Competition set to begin July 1996. Industry workshops in progress. |
| Idaho | Prohibited | | | Competition not allowed for customers with less than 5 lines. |
| Iowa | May 1995 | Yes | Not yet | Local interconnection tariff filed; hearings scheduled January 1996. |
| Minnesota | August 1995 | | Not yet | Rules docket in progress. Industry workshops in progress. |
| Montana | Not prohibited | | | Competition not yet being considered. |
| Nebraska | Not prohibited | | | Currently under consideration. Industry workshops in progress. |
| New Mexico | 1995 | | | Companies serving less than 100,000 lines are exempt from competition. |
| North Dakota | No regulatory barrier. | | | Competition not yet being considered. |
| Oregon | 1993 | Yes | Not yet | Certification order pending; expected by end of year 1995. |
| South Dakota | Yes | | | No actions have been taken yet. |
| Utah | 1995 | Yes | | Contracts must be developed between firms. Local interconnection tariff filed; hearings scheduled January 1996. |
| Washington | 1994 | Yes | Yes | Active local competition. October 1995 order for interim arrangements; final local interconnection tariff July 1996. |
| Wyoming | 1995 | | | Rules not in place yet. Local interconnection tariff filed September 1995; pending approval. |

CERTIFICATE OF SERVICE

I, Kelseau Powe, Jr., do hereby certify that on this 11th day of January, 1996,
I have caused a copy of the foregoing **COMMENTS OF U S WEST
COMMUNICATIONS, INC.** to be served via hand-delivery, upon the persons
listed on the attached service list.



Kelseau Powe, Jr.

James H. Quello
Federal Communications Commission
Room 802
1919 M Street, N.W.
Washington, DC 20554

Andrew C. Barrett
Federal Communications Commission
Room 826
1919 M Street, N.W.
Washington, DC 20554

Reed E. Hundt
Federal Communications Commission
Room 814
1919 M Street, N.W.
Washington, DC 20554

Susan P. Ness
Federal Communications Commission
Room 832
1919 M Street, N.W.
Washington, DC 20554

Rachelle B. Chong
Federal Communications Commission
Room 844
1919 M Street, N.W.
Washington, DC 20554

Regina M. Keeney
Federal Communications Commission
Room 500
1919 M Street, N.W.
Washington, DC 20554

Karen Brinkmann
Federal Communications Commission
Room 500
1919 M Street, N.W.
Washington, DC 20554

Les Selzer
Federal Communications Commission
Room 500
1919 M Street, N.W.
Washington, DC 20554

Peyton L. Wynn
Federal Communications Commission
Room 500
2033 M Street, N.W.
Washington, DC 20554

Tariff Division
Common Carrier Bureau
Room 518
1919 M Street, N.W.
Washington, DC 20554
(2 copies)

James H. Quello
Federal Communications Commission
Room 802
1919 M Street, N.W.
Washington, DC 20554

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Federal Communications Commission
Room 500
1919 M Street, N.W.
Washington, DC 20554

Peyton L. Wynns
Federal Communications Commission
Room 500
2033 M Street, N.W.
Washington, DC 20554

Tariff Division
Common Carrier Bureau
Room 518
1919 M Street, N.W.
Washington, DC 20554
(2 copies)

Industry Analysis Division
Common Carrier Bureau
Room 500
2033 M Street, N.W.
Washington, DC 20554
(Diskette)

Steven Spaeth
Federal Communications Commission
Room 518
1919 M Street, N.W.
Washington, DC 20554

International Transcription
Services, Inc.
Suite 140
2100 M Street, N.W.
Washington, DC 20037

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